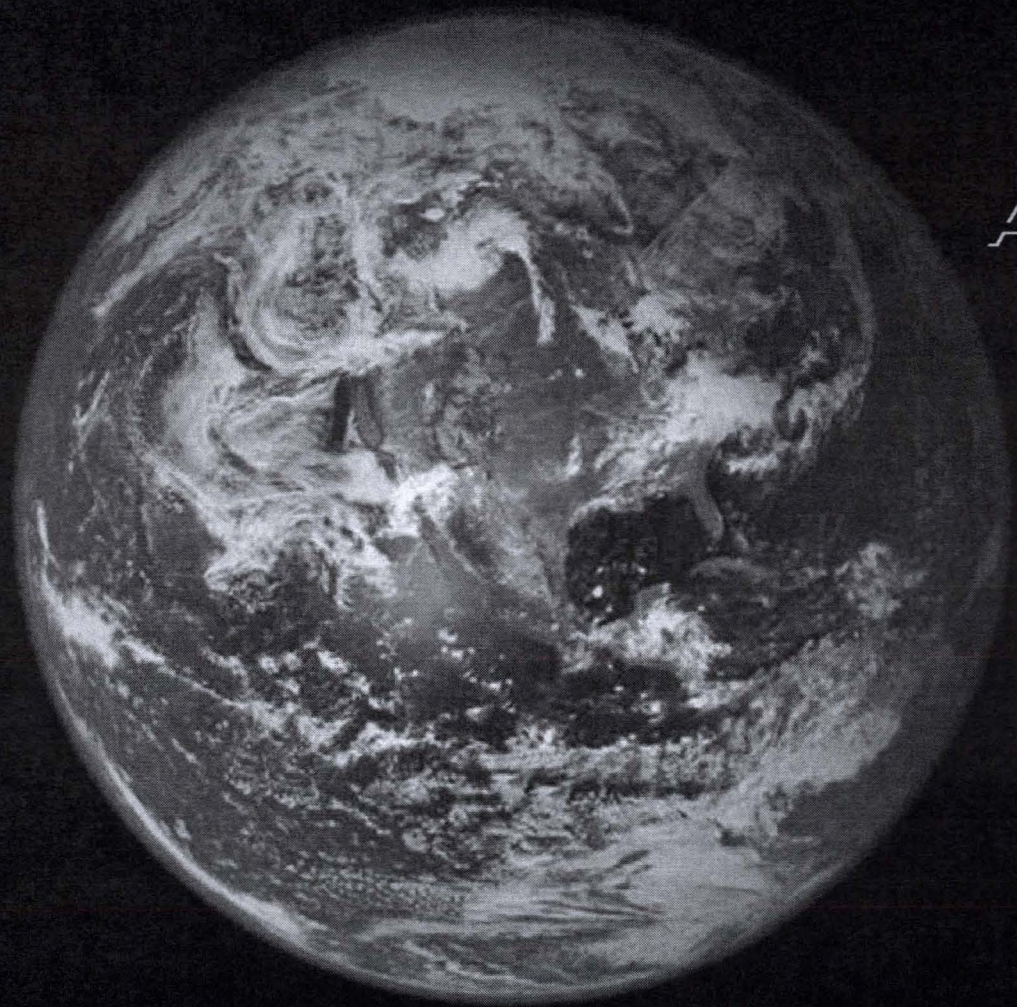
MSFC-769-ABSTRACT

Abstract
UID...Leaving Its Mark on the Universe

Since 1975 bar codes on products at the retail counter have been accepted as the standard for entering product identity for price determination. Since the beginning of the 21st century, the Data Matrix symbol has become accepted as the bar code format that is marked directly on a part, assembly or product that is durable enough to identify that item for its lifetime. NASA began the studies for direct part marking Data Matrix symbols on parts during the Return to Flight activities after the Challenger Accident. Over the 20 year period that has elapsed since Challenger, a mountain of studies, analyses and focused problem solutions developed by and for NASA have brought about world changing results. NASA Technical Standard 6002 and NASA Handbook 6003 for Direct Part Marking Data Matrix Symbols on Aerospace Parts have formed the basis for most other standards on part marking internationally. NASA and its commercial partners have developed numerous products and methods that addressed the difficulties of collecting part identification in aerospace operations. These products enabled the marking of Data Matrix symbols in virtually every situation and the reading of symbols at great distances, severe angles, under paint and in the dark without a light. Even unmarkable delicate parts now have a process to apply a chemical mixture, recently trademarked as Nanocodes, that can be converted to Data Matrix information through software. The accompanying intellectual property is protected by ten patents, several of which are licensed. Direct marking Data Matrix on NASA parts dramatically decreases data entry errors and the number of parts that go through their life cycle unmarked, two major threats to sound configuration management and flight safety. NASA is said to only have people and stuff with information connecting them. Data Matrix is one of the most significant improvements since Challenger to the safety and reliability of that connection.

MSFC-769 - PRESENTATION

AIAG



AIAG
Auto ID/RFID Showcase
Novi, MI
April 30, 2008

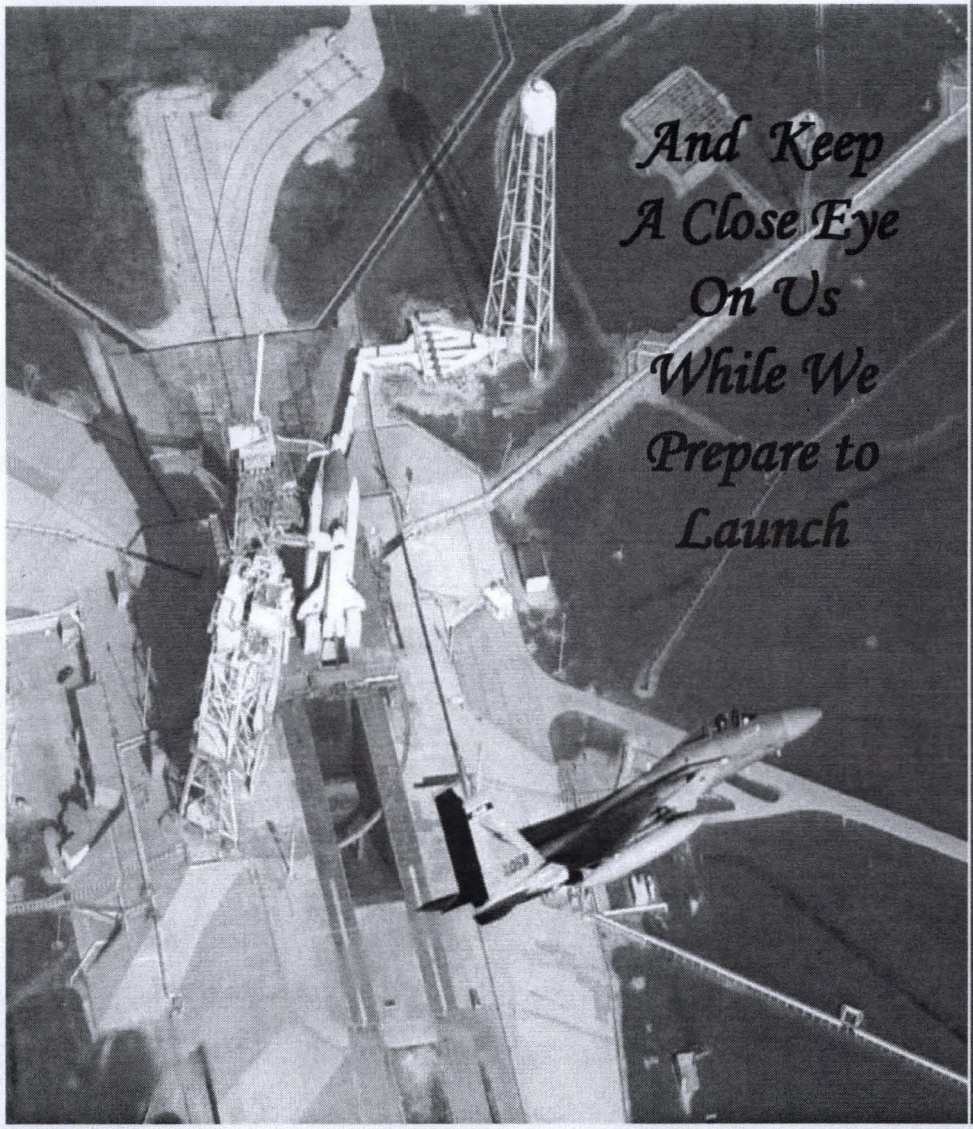
Fred Schramm

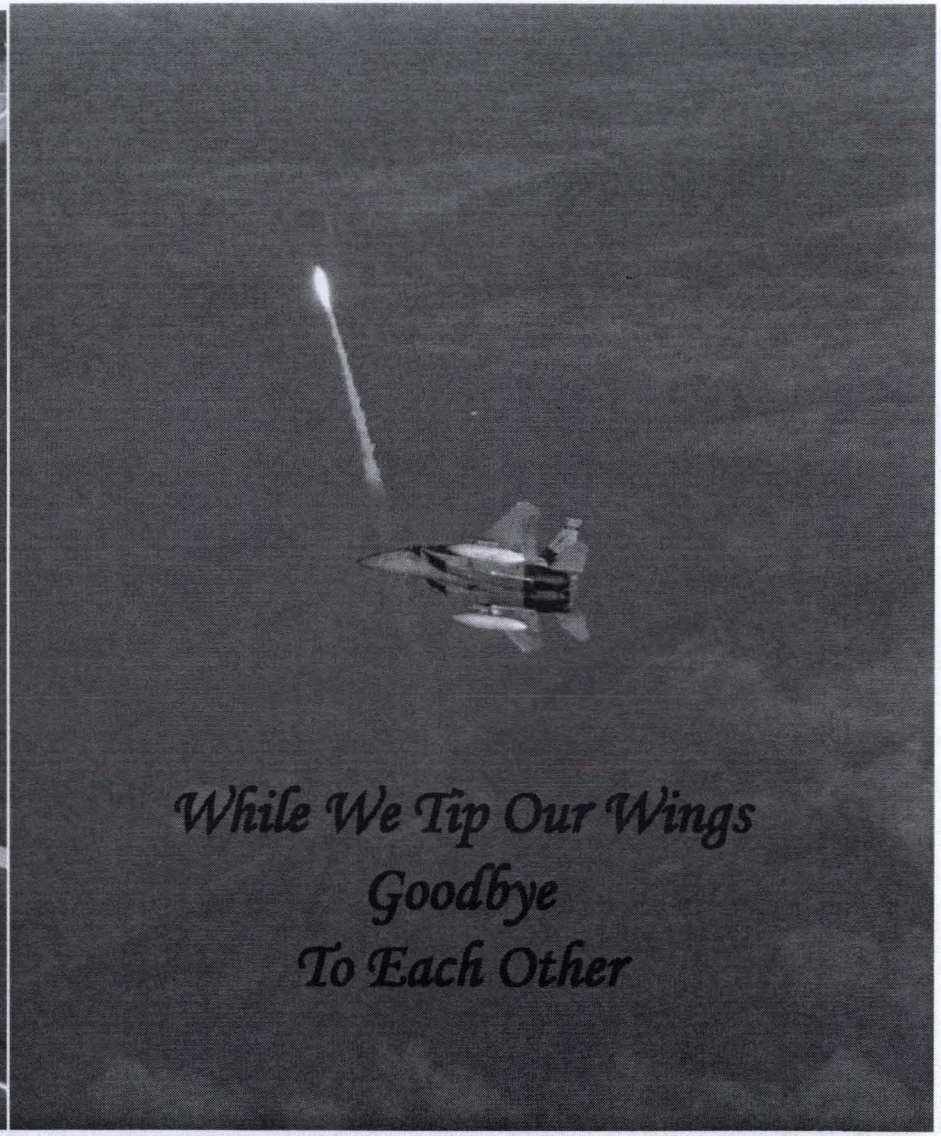
National Aeronautics and Space Administration

Marshall Space Flight Center

NASA

NASA Thanks Those Who
Protect Our Freedom
Global, Homeland, Hometown


And Keep
A Close Eye
On Us
While We
Prepare to
Launch

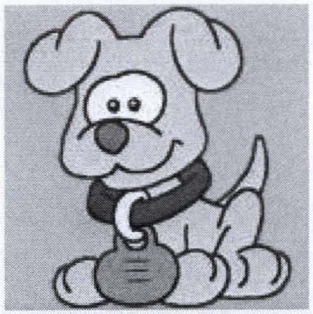

While We Tip Our Wings
Goodbye
To Each Other

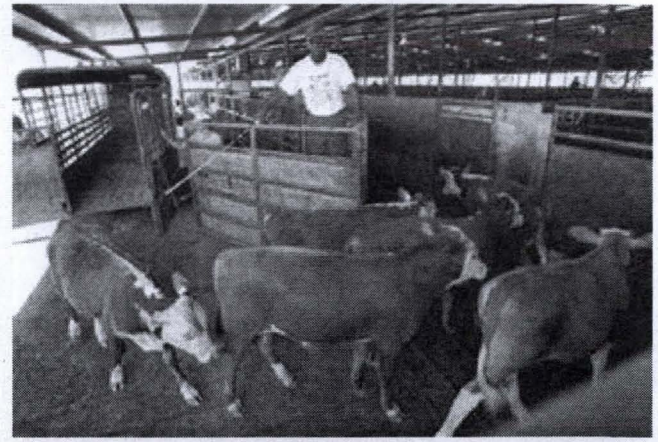
AIAG

Today's World….More Things Being Tracked
……..For Safety
……..And Because We Can

USDA United States Department of Agriculture

NATIONAL ANIMAL ID SYSTEM
WILL GUARD AGAINST MAD COW DISEASE
AND ANIMAL HEALTH PROBLEMS





NASA

Different Organizations Track Products for Different Reasons

Accountability

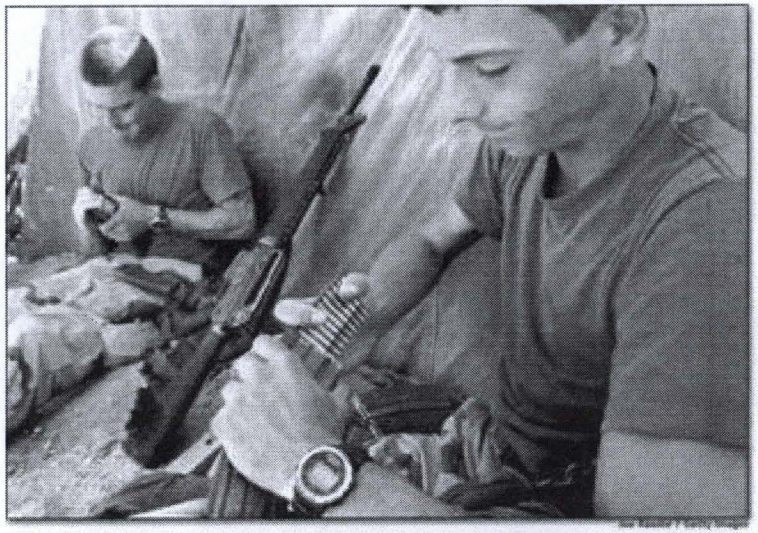
Configuration Management

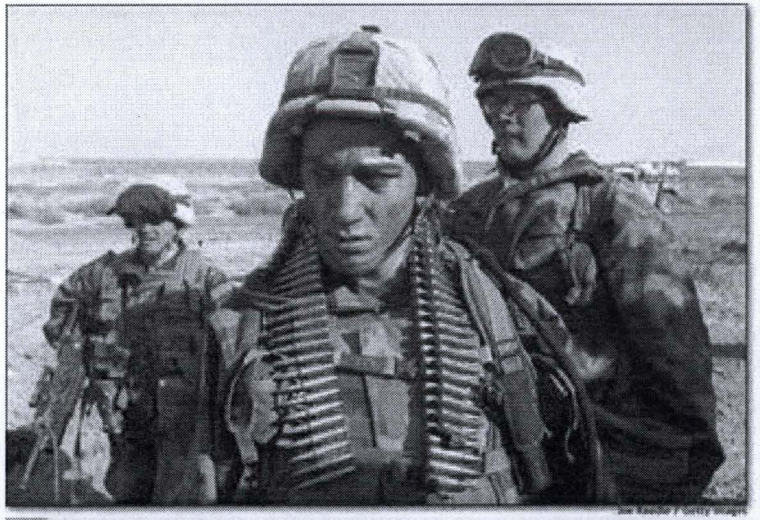
Readiness

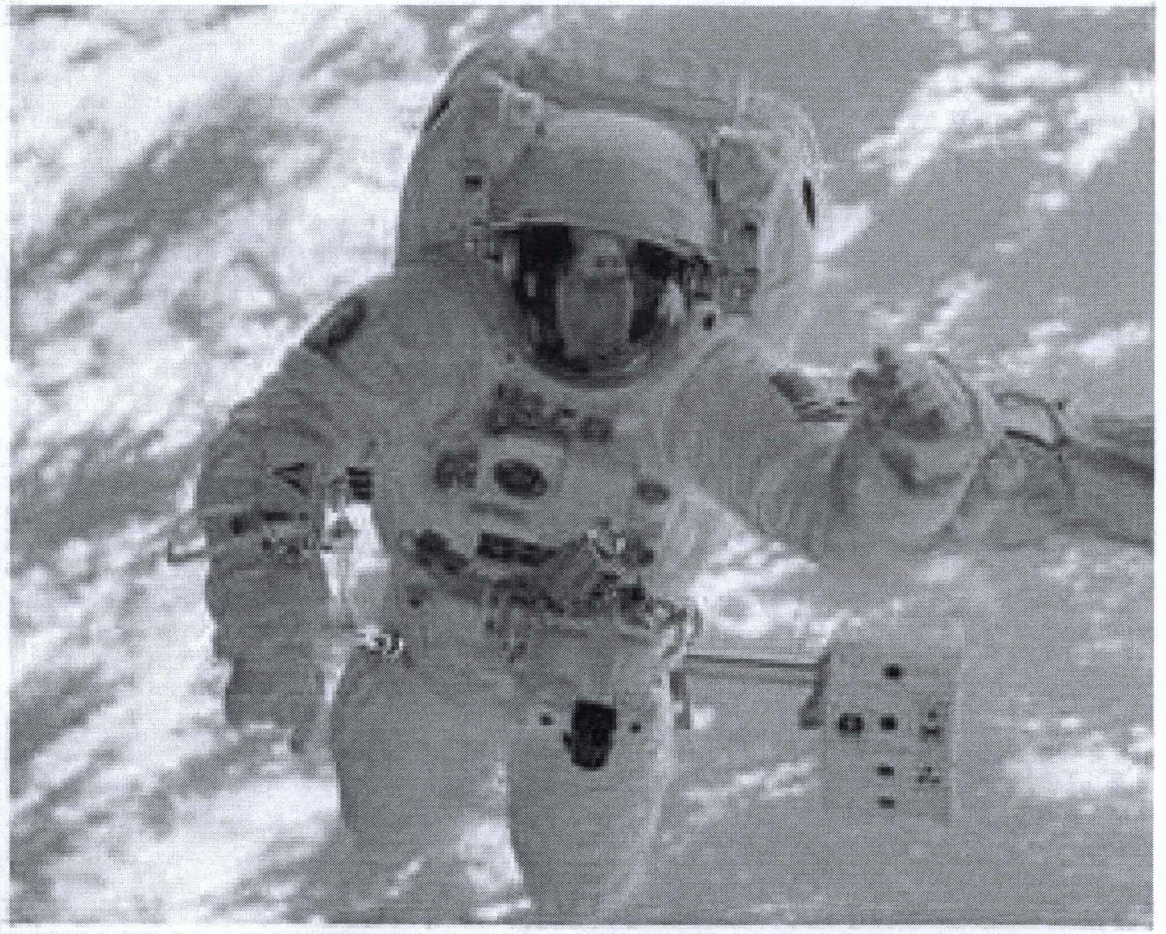
Logistics

AIAG

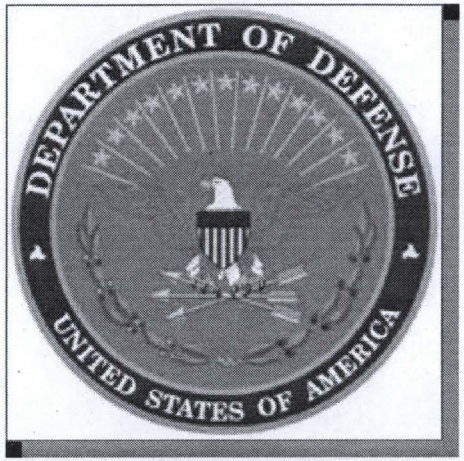
IUID… Tracking for a Reason

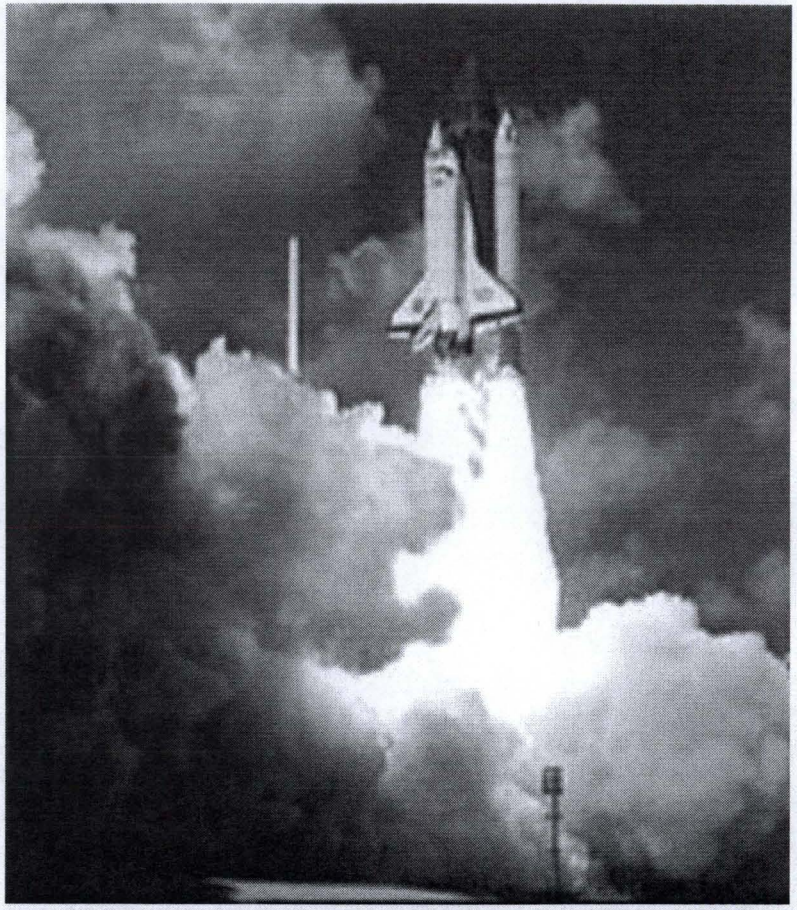






Requirements to Track Products Start with Identification

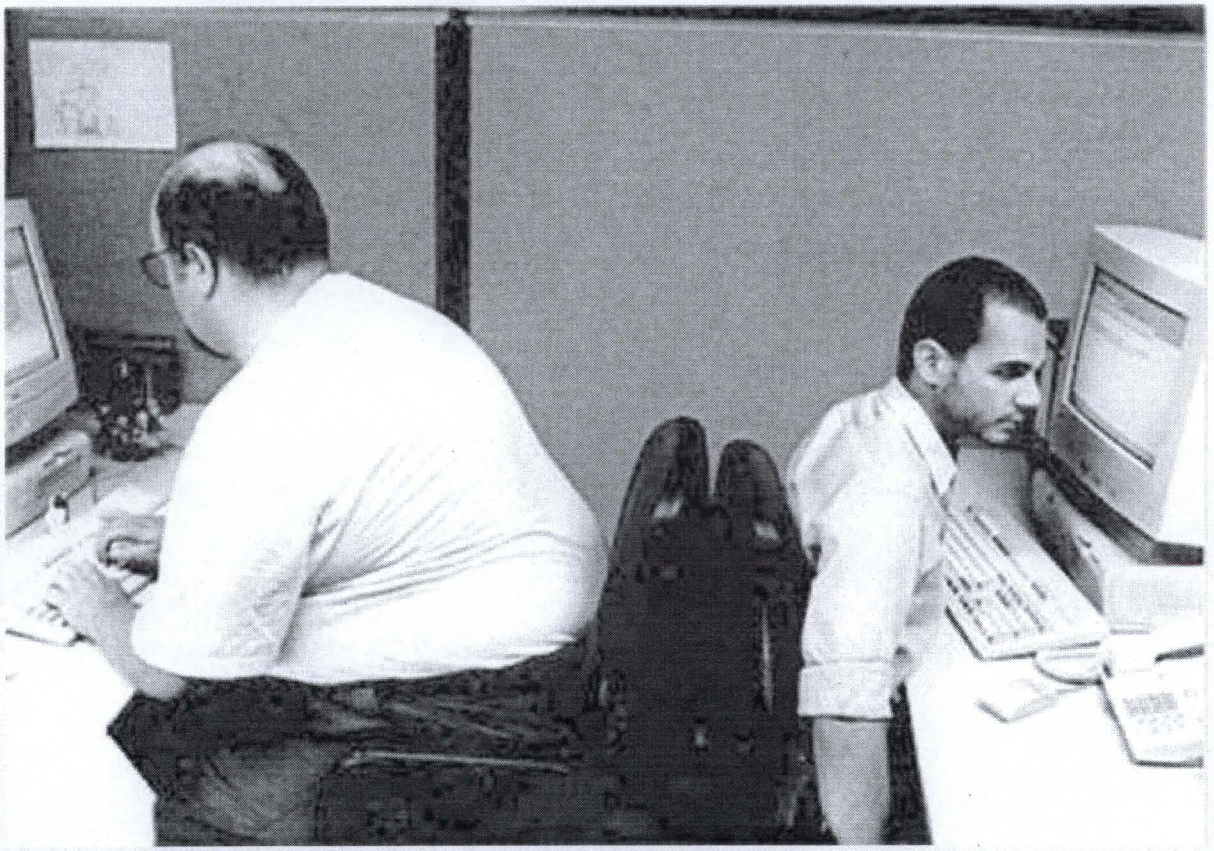




Part Numbers and Serial Numbers Identify One Part From the Other

CAGE Numbers Identify One Supplier from the Other

Items that Require Identity Capture… IUID or Not—Mark by the Standards



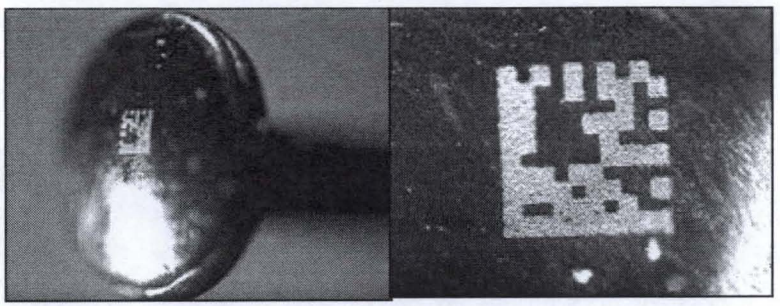
MIL STD 130…
Labels, Tags, Nameplates for DoD and NASA

MIL STD 130…
Direct Part Marking for DoD

NASA STD 6002
Direct Part Marking for NASA

IUID Uses 2D* – Great *where space is limited or permanence required

IUID… Direct Part Marking



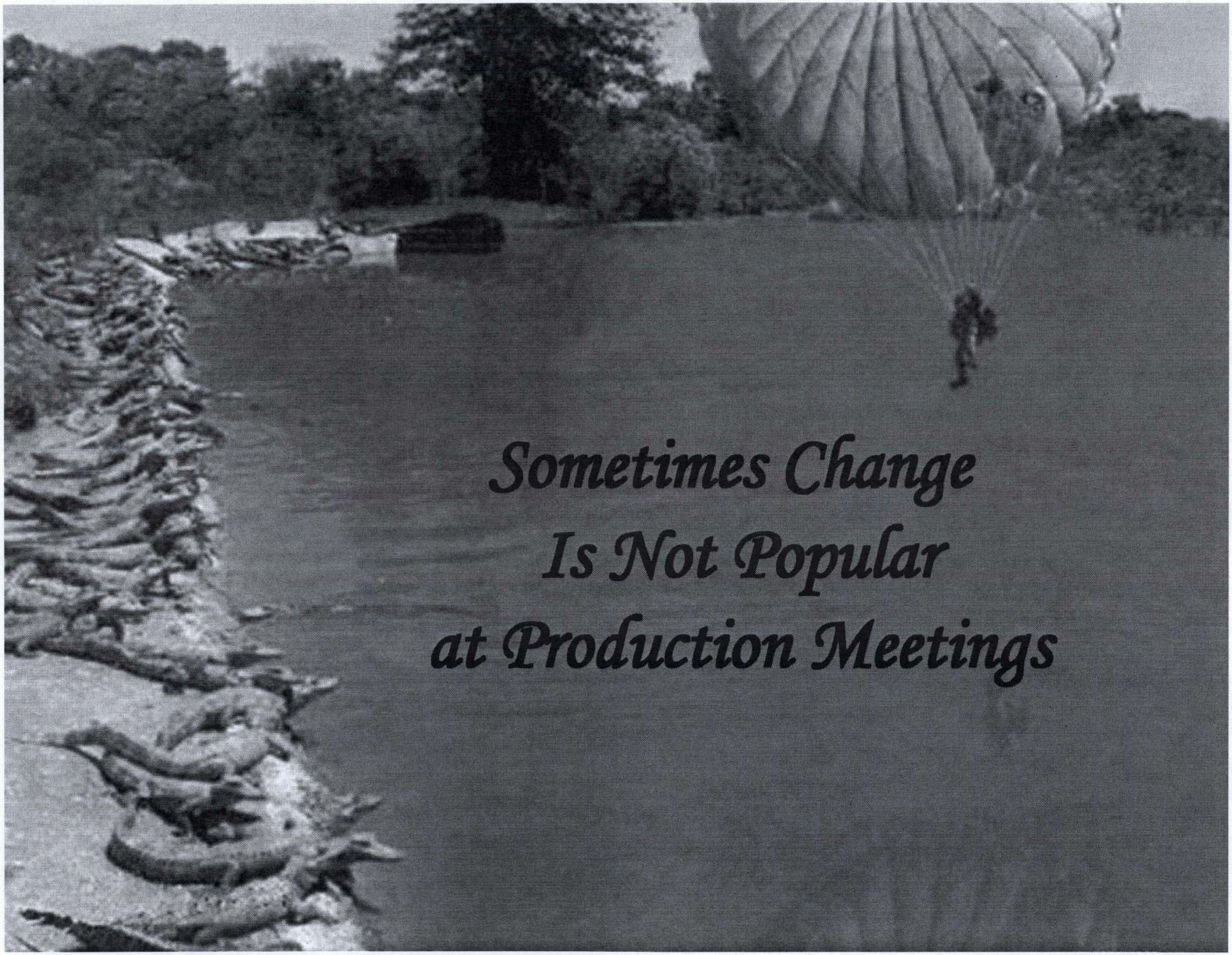
NASA's Primary Emphasis
….Item-Level Traceability Requires IUID
….MIL STD 130/NASA STD 6002C
use same symbol format

A properly engineered and applied mark is a:
FLAWLESS IMPERFECTION

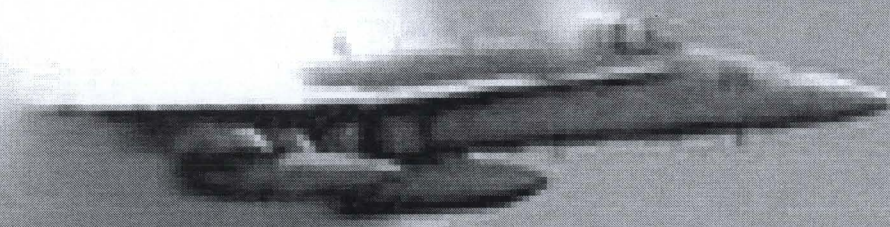
Know the Pedigree
….Know who made it
….Know who marked it
….Know who stands behind it

NASA Materials and Processes Community Of Practice

http://maptis.nasa.gov/NASA_MP_COP.html


Sometimes Change
Is Not Popular
at Production Meetings

But Change Is Not As Hard As Breaking the Sound Barrier

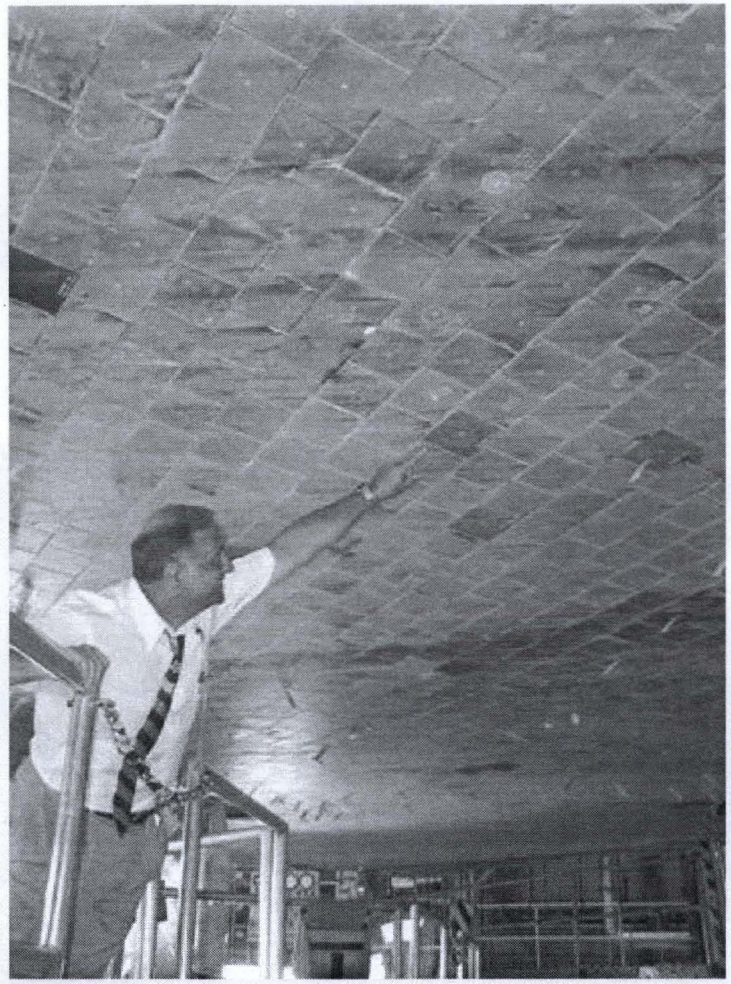


And Our DoD Friends Do That Every Day

AIAG

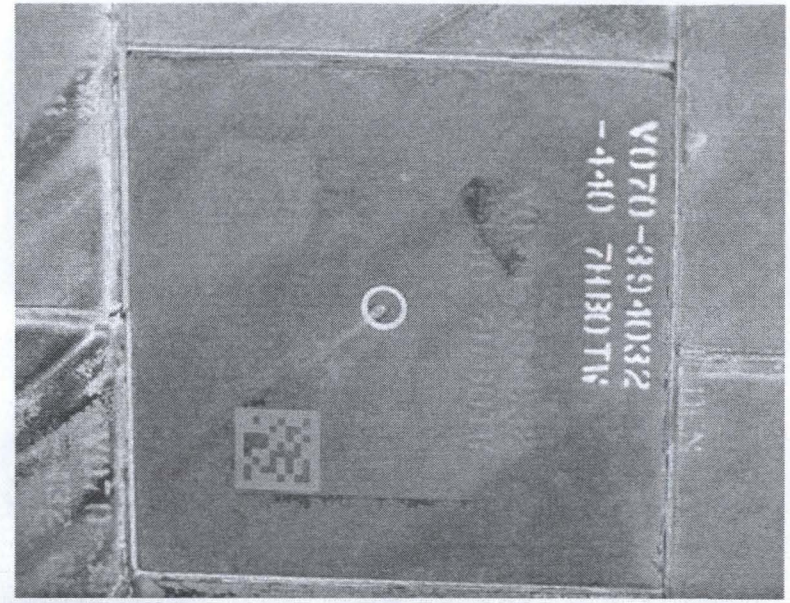
Jungle, Sand or Space…
Your Car or NASCAR
IUID Presents Some Direct
Part Marking and Reading Problems

Tests for Repeated Exposure to Extremes

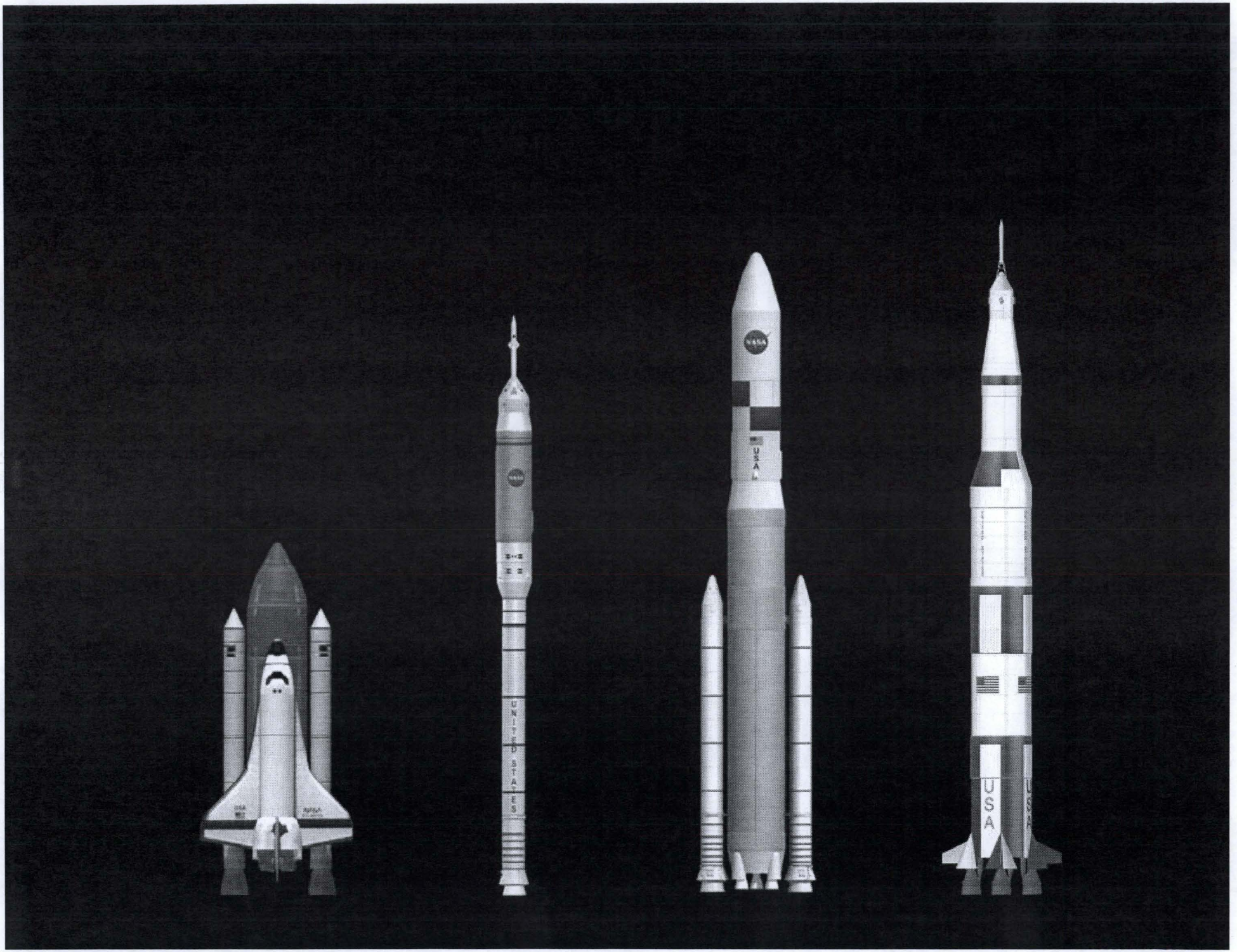


Thermal Protection System-- 3 Marked Shuttle Tile Remain

19 Times in Space on OV-103 (Discovery)

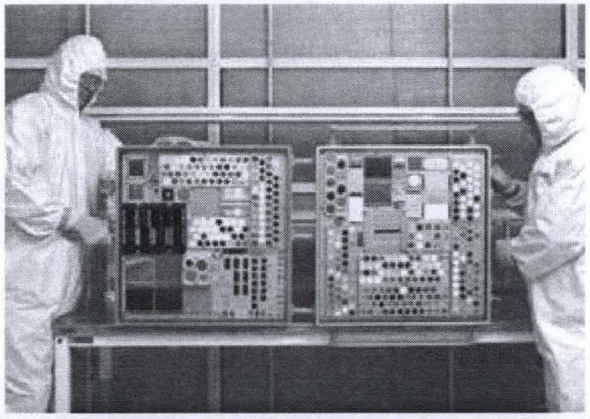


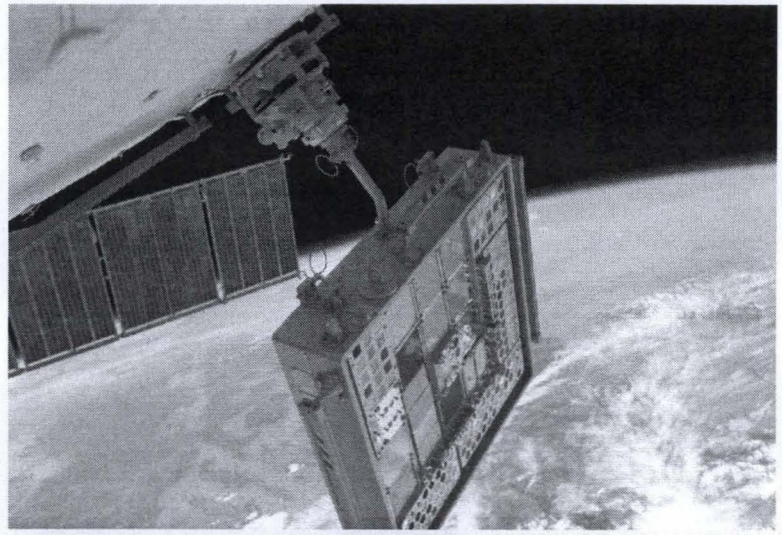
Looking Good And Readable


UNITED STATES
USA
USA
USA

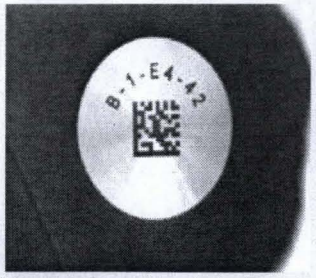
Materials- International Space Station- Experiment

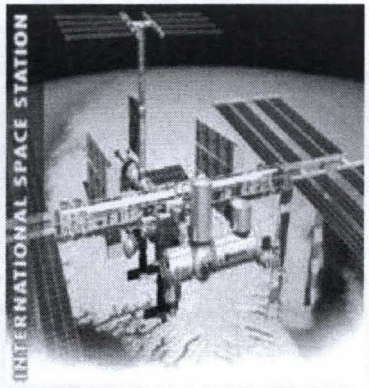
Marking Development for Long Term Space Exposure

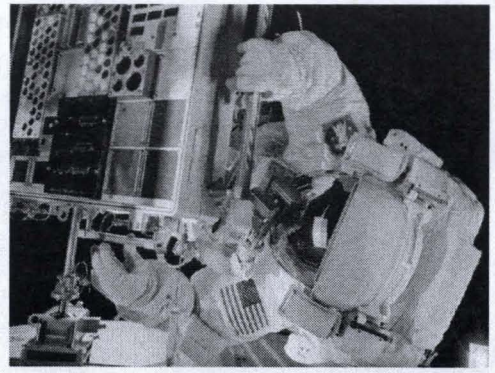




Exposes Samples to Space For A Year







MISSE 1&2 and 3&4 Results Will Be In NASA STD 6002 by 2010

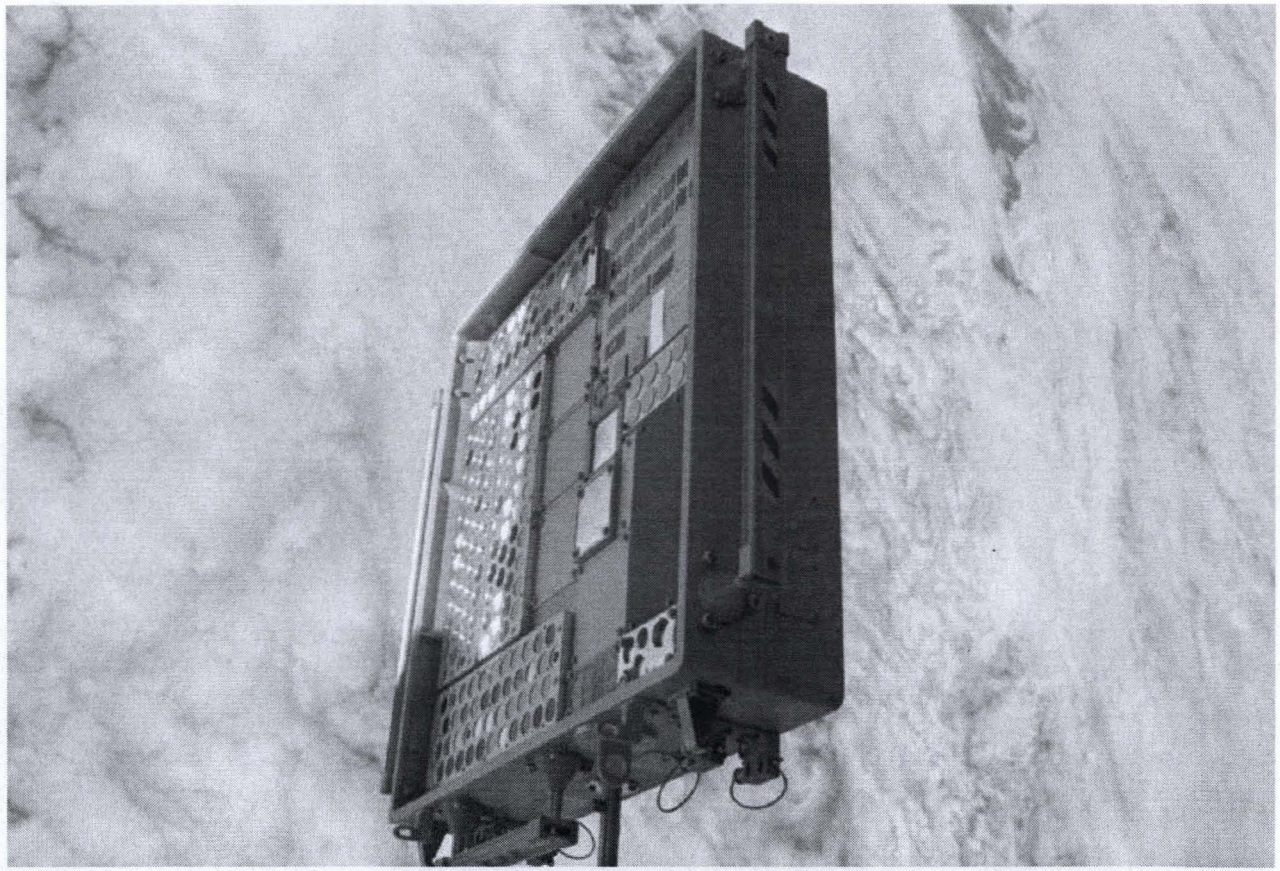
Tests for Long Term Space Exposure (MISSE 6)

Carries laser bonded Data Matrix samples

Carries Nanocodes™ in various coatings and one dot peened into coupon

Carries one paper RFID tag and one encased in plastic—attached to face of tray

Launched aboard Endeavor March 2008



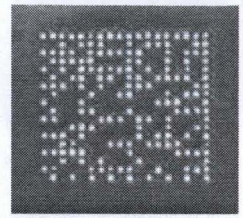
Distance/Read Through Paint Combined Scanner

(Space Station Technology Spinoff)

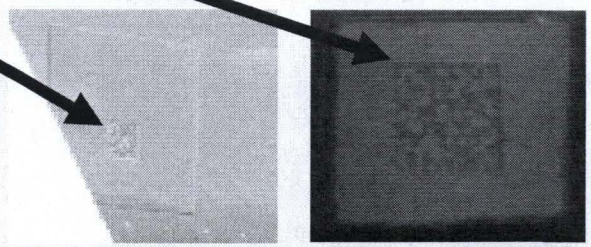
(Space Shuttle Technology Spinoff)

Optical Scanner
2'..20'..60'

No contrast mark on smooth aluminum at 30 degree angle



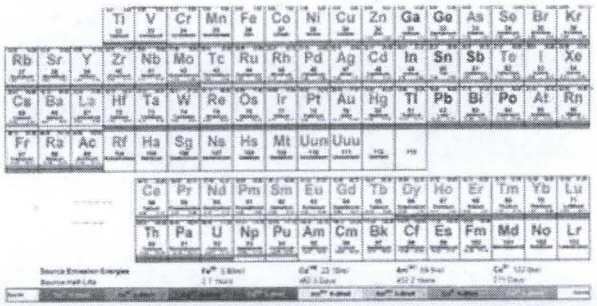
Magnetic mark survived 24+ months of Coast Guard duty—Read through 6 layers of paint



Shiny screwdriver

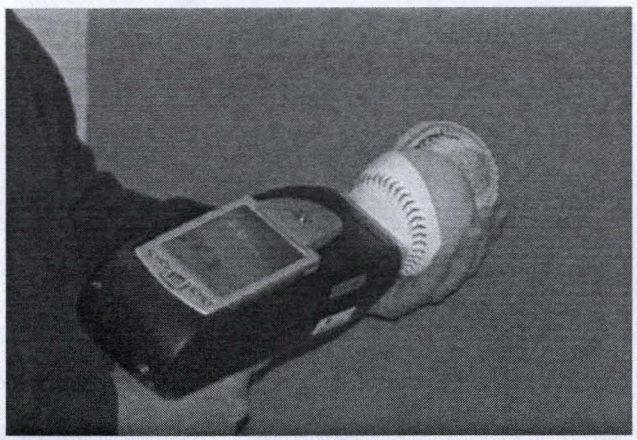
Ares I Infusion Spinoff
The Unmarkable Part Gets Secret Authentication

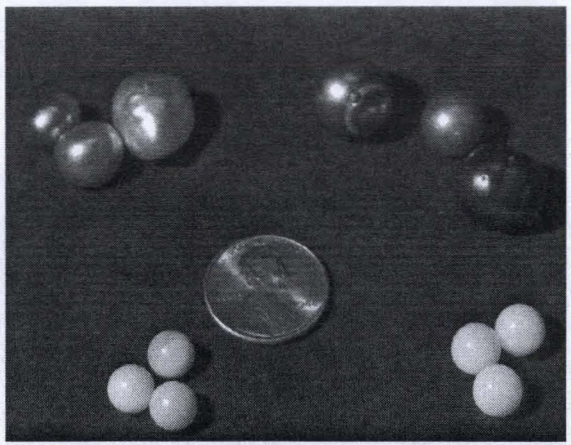
Nanocodes™ = the mark (a chemical bar code)

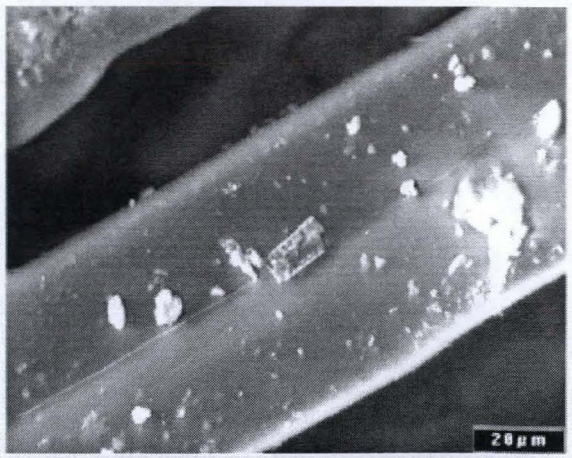


=> Conversion <=

X-ray Fluorescence Software converts to ASCII

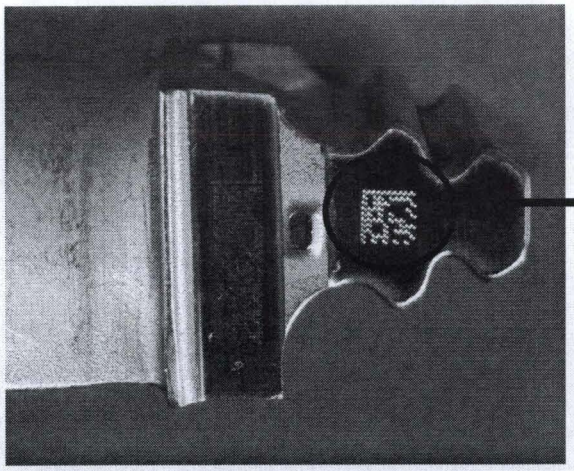


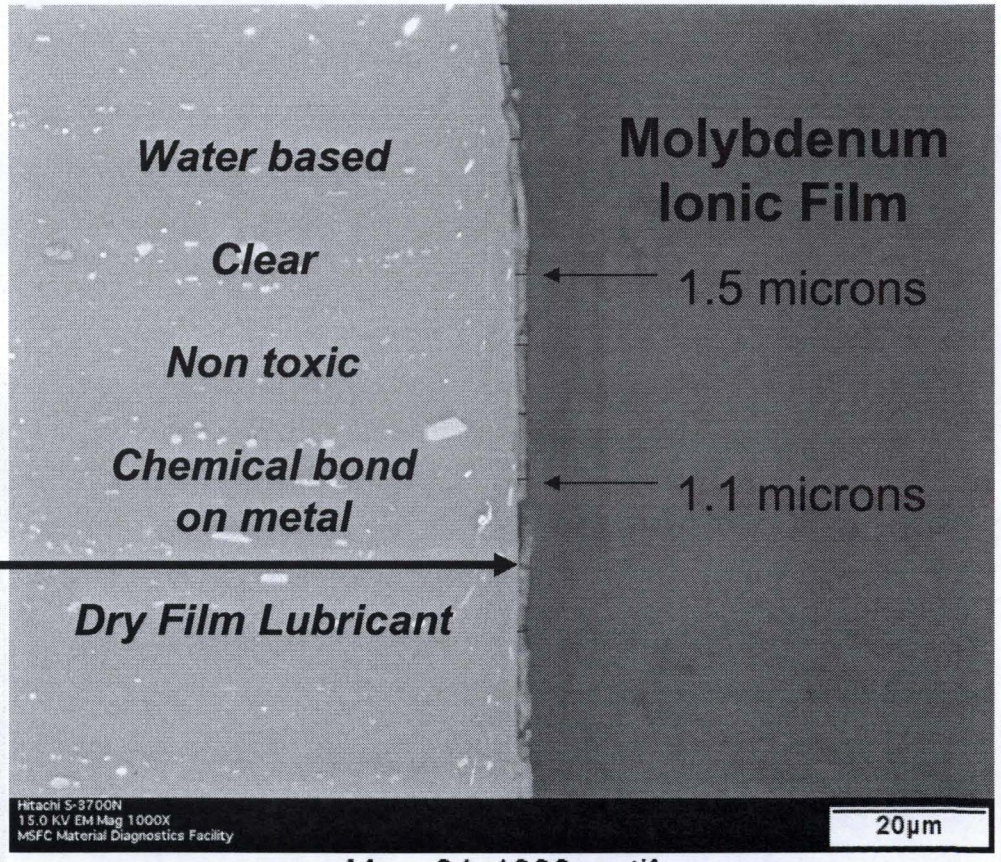




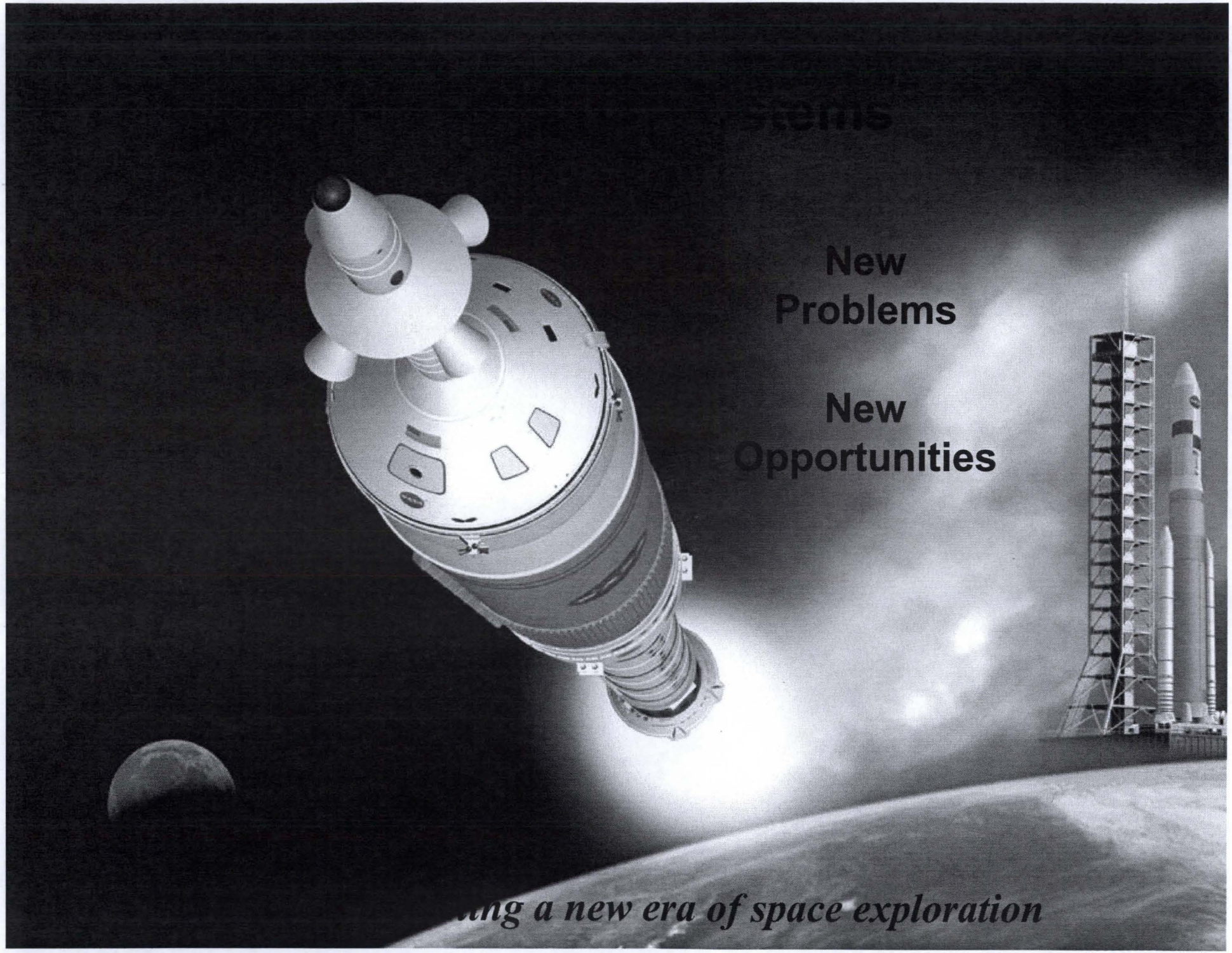
Visible Mark Protection Remedy… Ares I Infusion Spinoff

Ionic Dry Films Nanoclusters

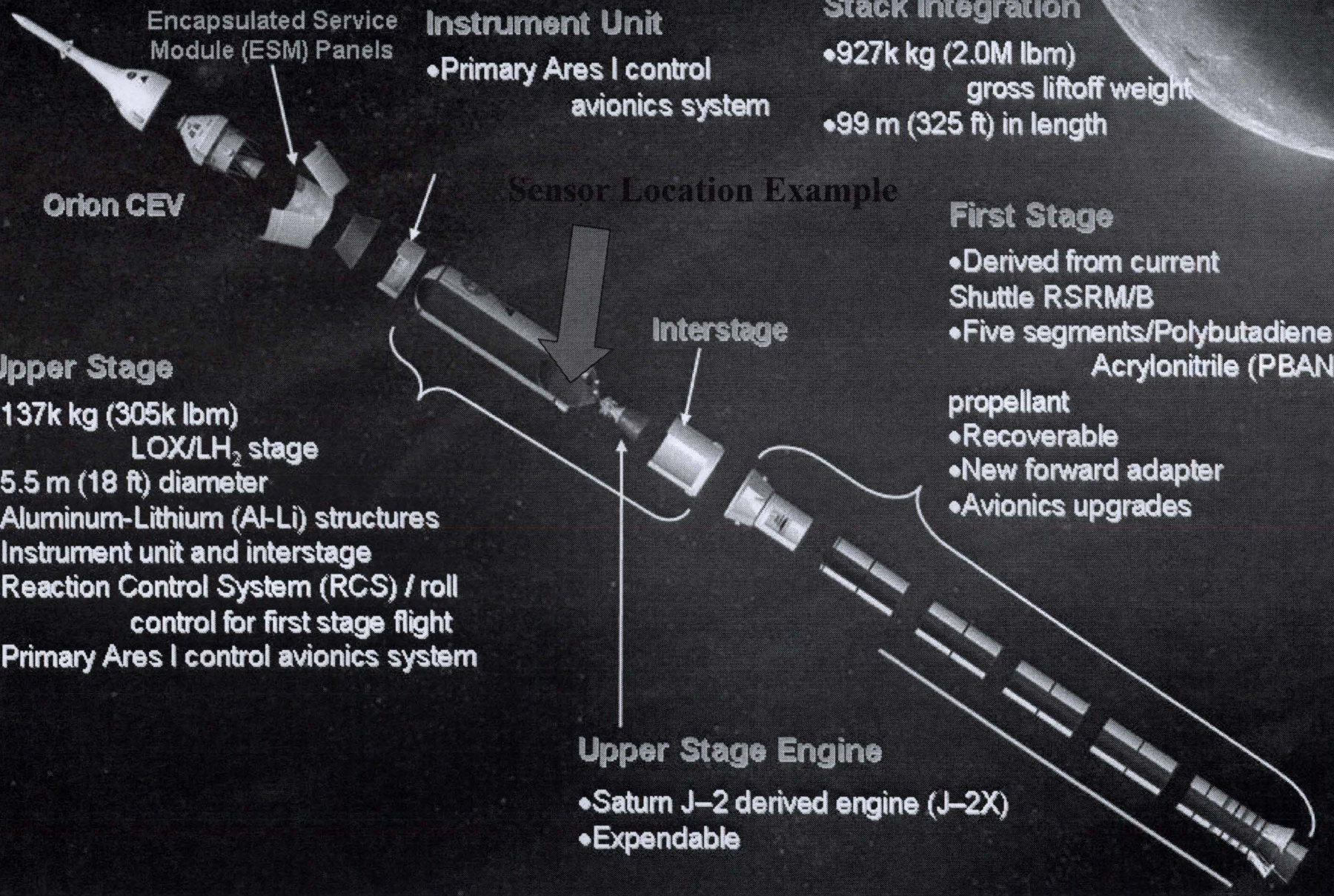




Mo_c04_1000xm.tif


New
Problems
New
Opportunities
ing a new era of space exploration

Ares I Elements



Instrument Unit

- Primary Ares I control avionics system

Stack Integration

- 927k kg (2.0M lbm) gross liftoff weight
- 99 m (325 ft) in length

Upper Stage

- 137k kg (305k lbm) LOX/LH_2 stage
- 5.5 m (18 ft) diameter
- Aluminum-Lithium (Al-Li) structures
- Instrument unit and interstage
- Reaction Control System (RCS) / roll control for first stage flight
- Primary Ares I control avionics system

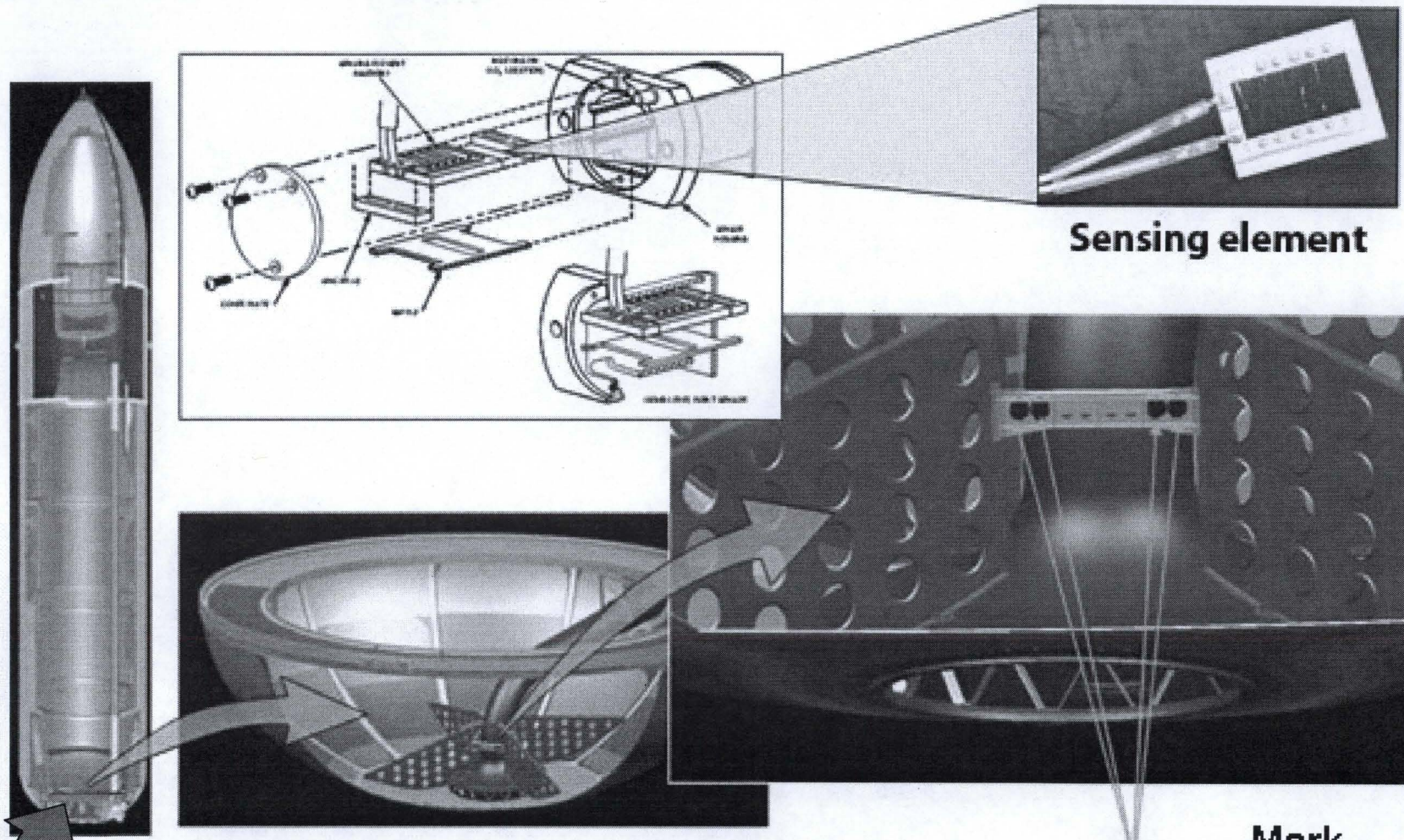
First Stage

- Derived from current Shuttle RSRM/B
- Five segments/Polybutadiene Acrylonitrile (PBAN) propellant
- Recoverable
- New forward adapter
- Avionics upgrades

Upper Stage Engine

- Saturn J–2 derived engine (J–2X)
- Expendable

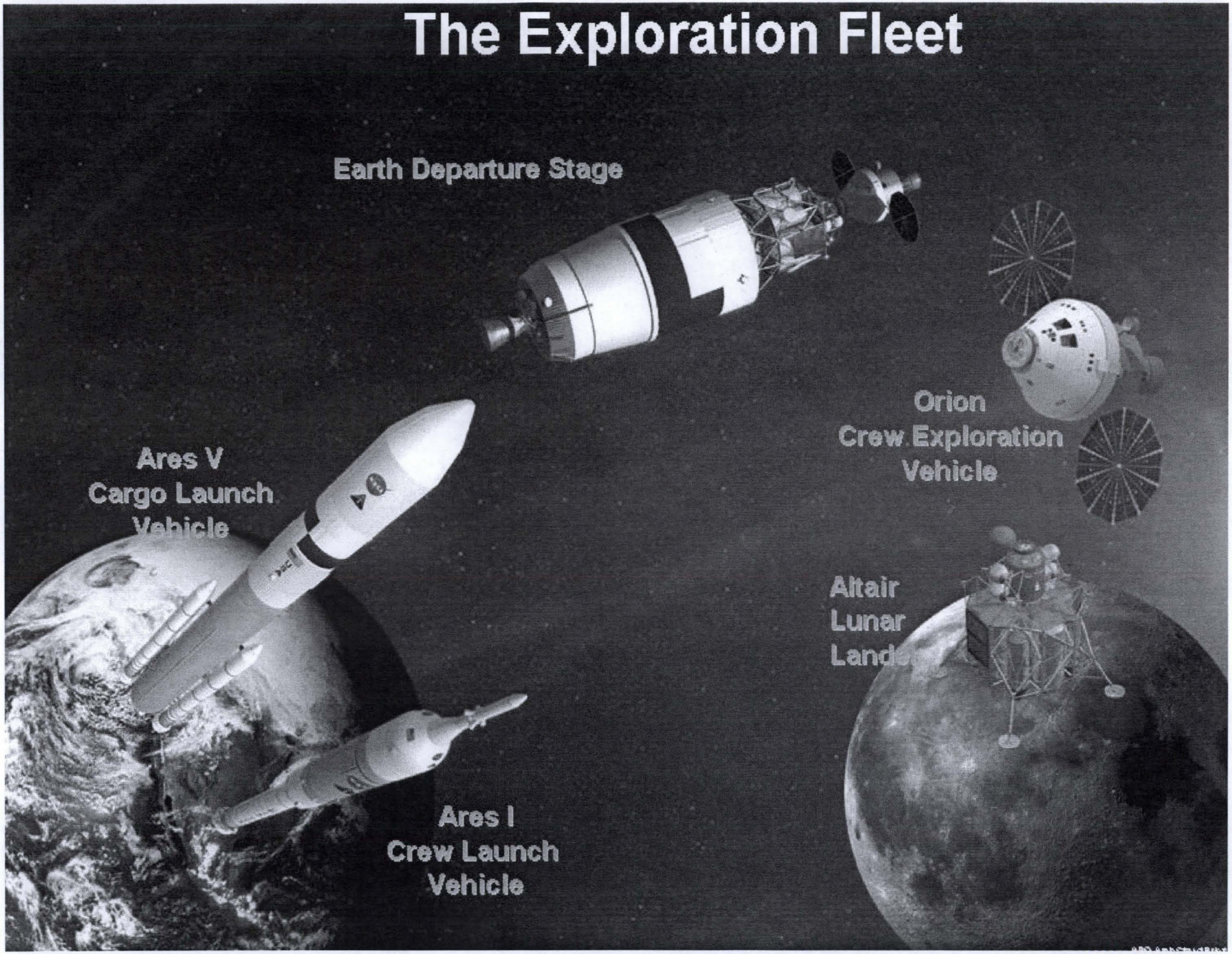
IUID Sensor Location Example

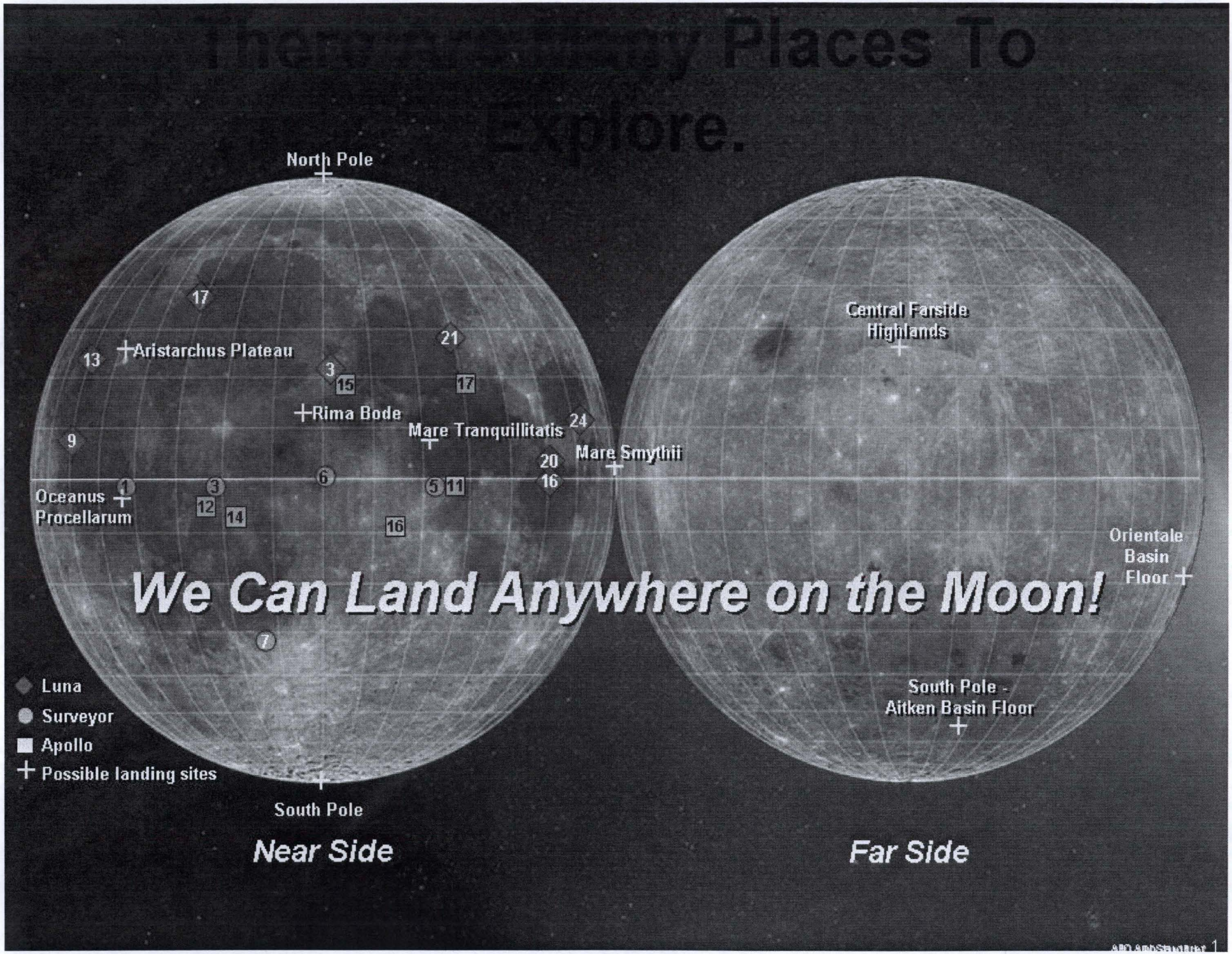


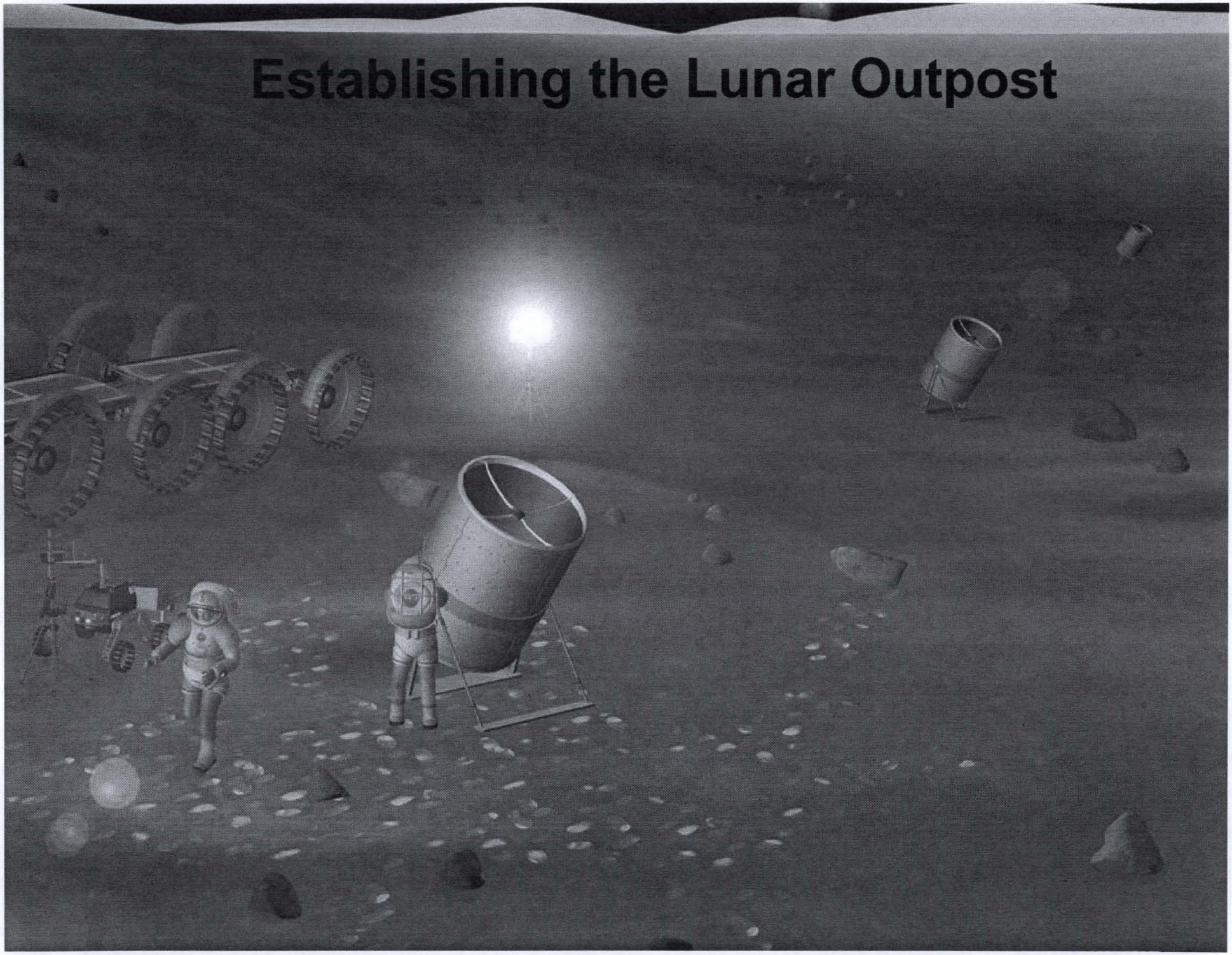
Sensing element

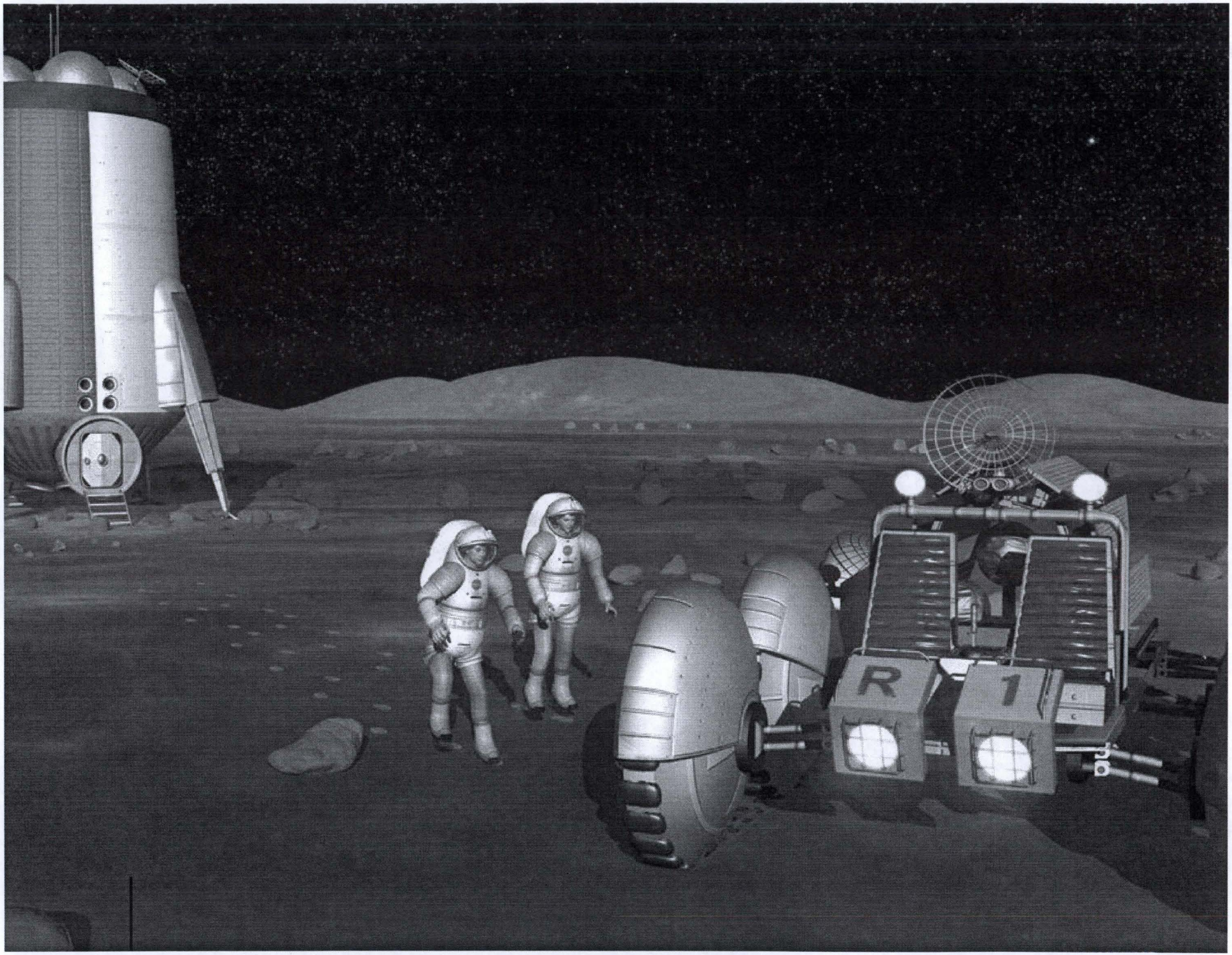
Shuttle External Tank LH2 Component Example

Mark Location
Ink Stamp/Chem Etch

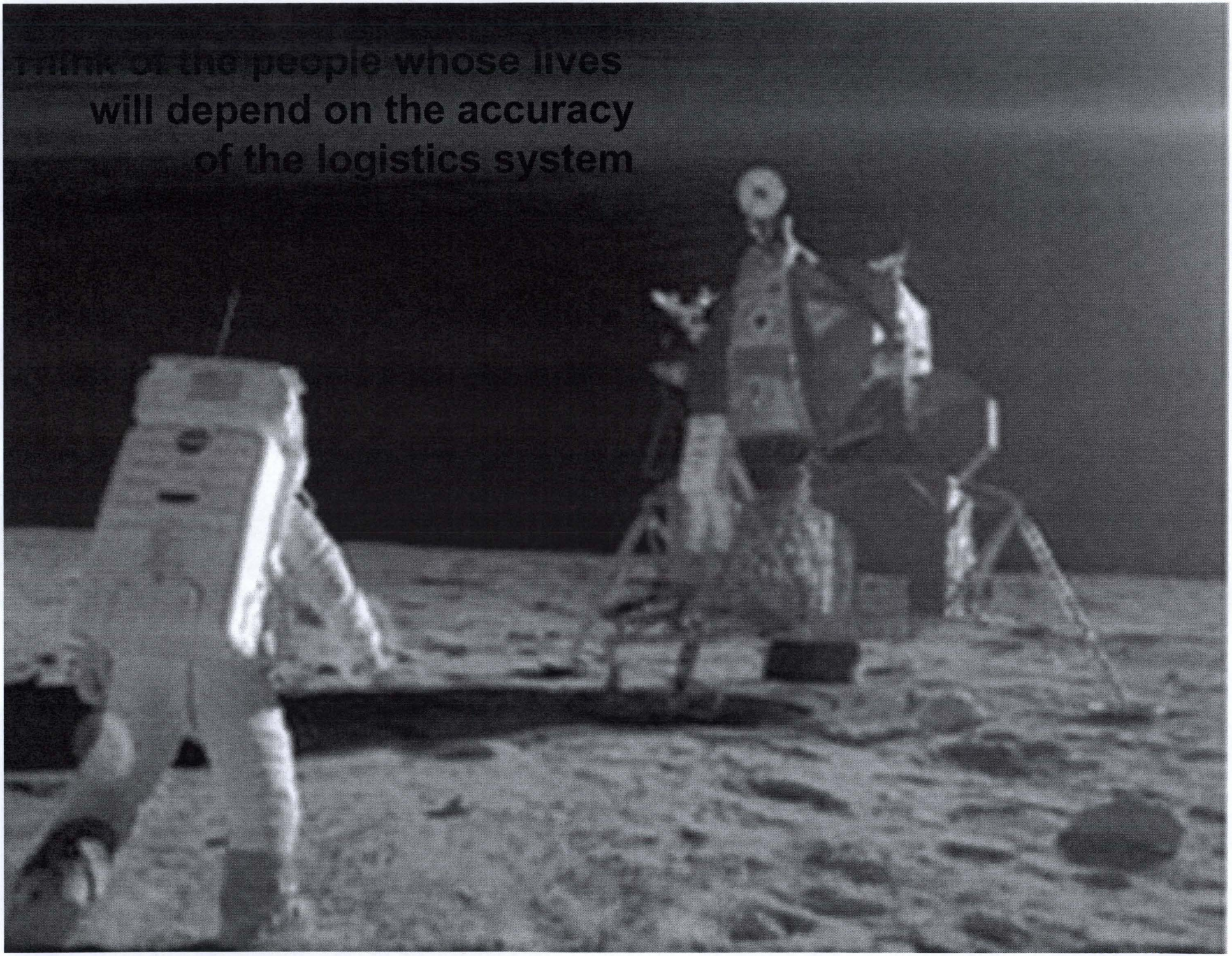

The Exploration Fleet
Earth Departure Stage
Orion
Crew Exploration
Vehicle
Ares V
Cargo Launch
Vehicle
Altair
Lunar
Lande
Ares I
Crew Launch
Vehicle

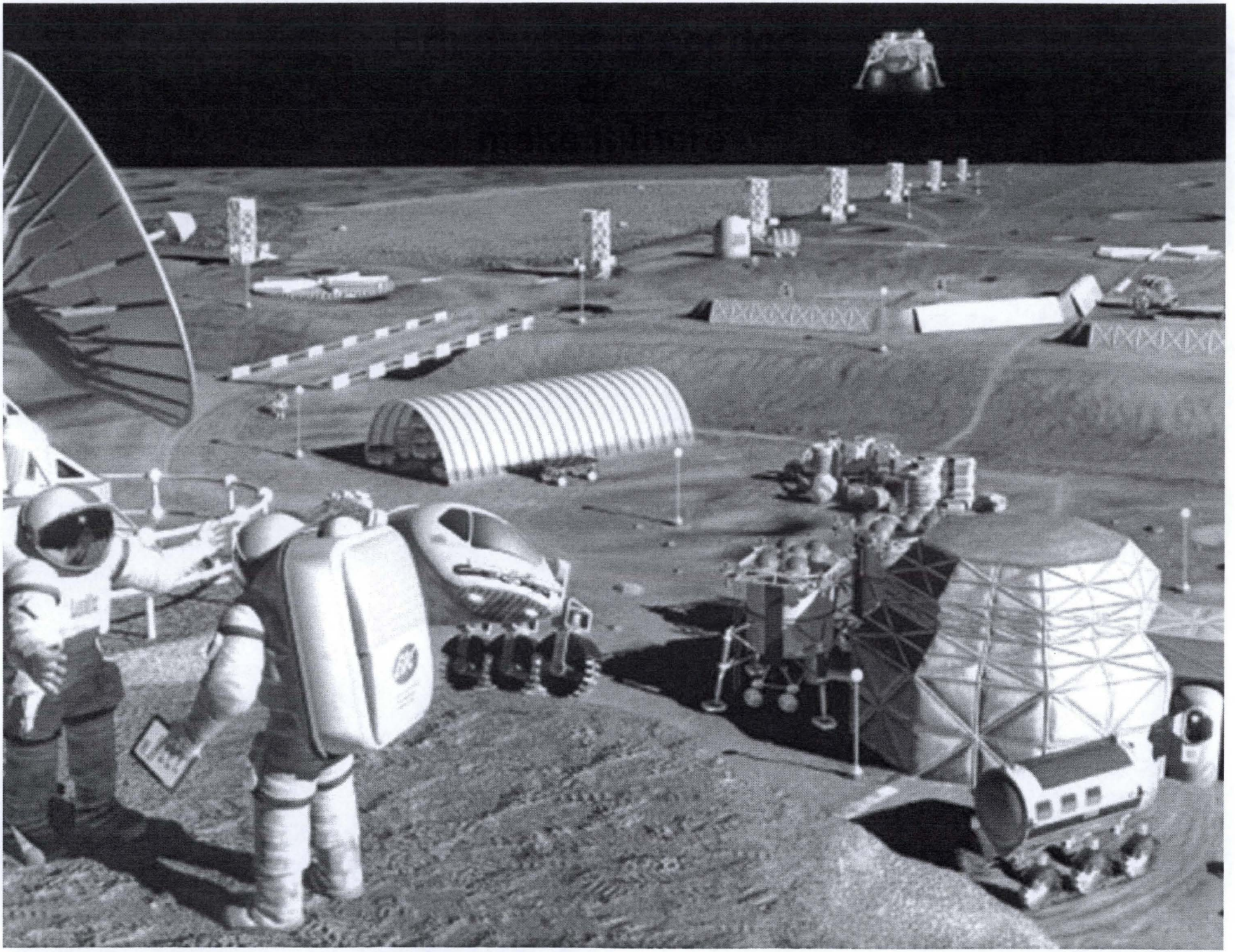

There are many Places To Explore.
North Pole
Aristarchus Plateau
Rima Bode
Mare Tranquillitatis
Mare Smythii
Oceanus Procellarum
Central Farside Highlands
Orientale Basin Floor
South Pole - Aitken Basin Floor
South Pole
We Can Land Anywhere on the Moon!
Luna
Surveyor
Apollo
Possible landing sites
Near Side
Far Side

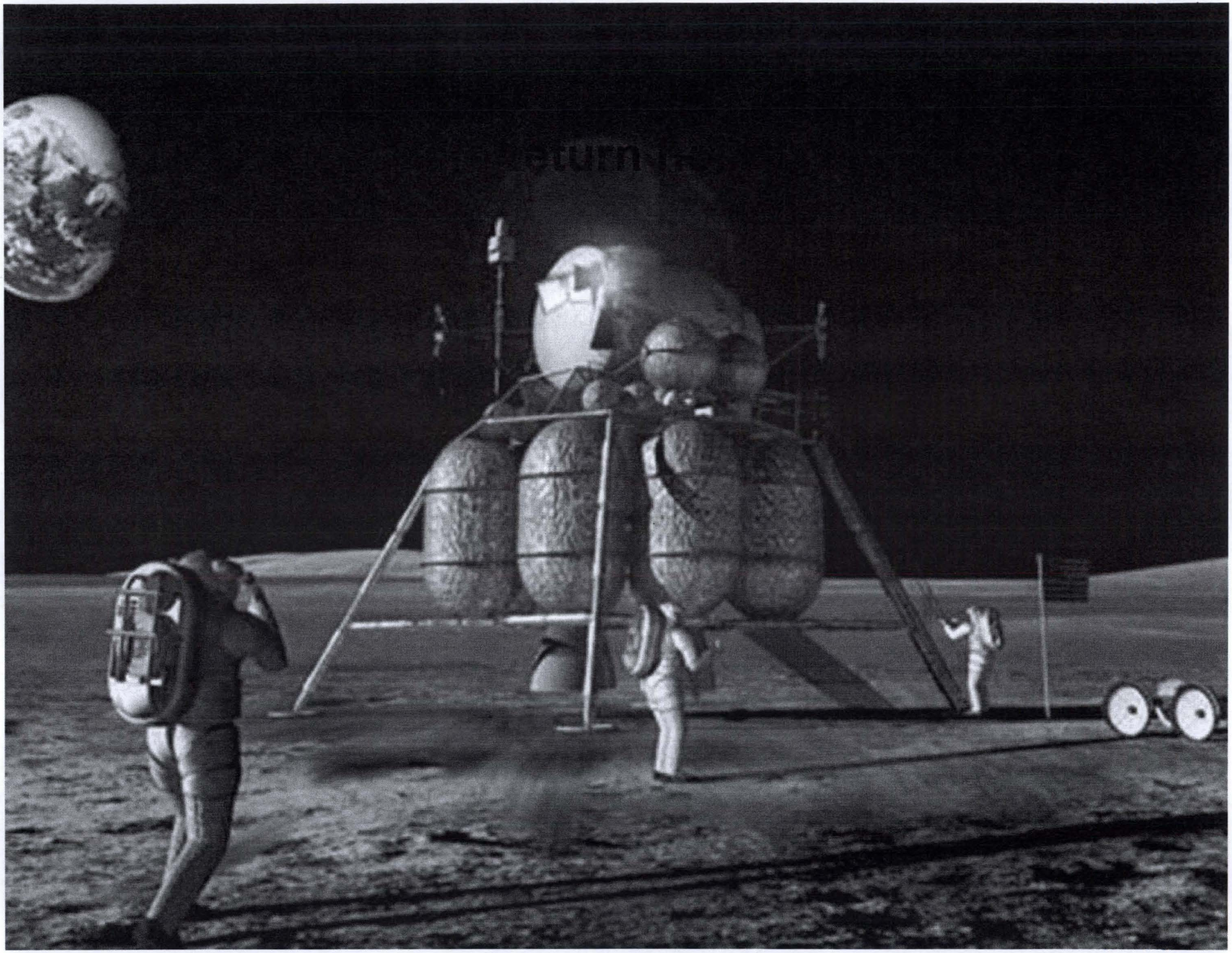

Establishing the Lunar Outpost

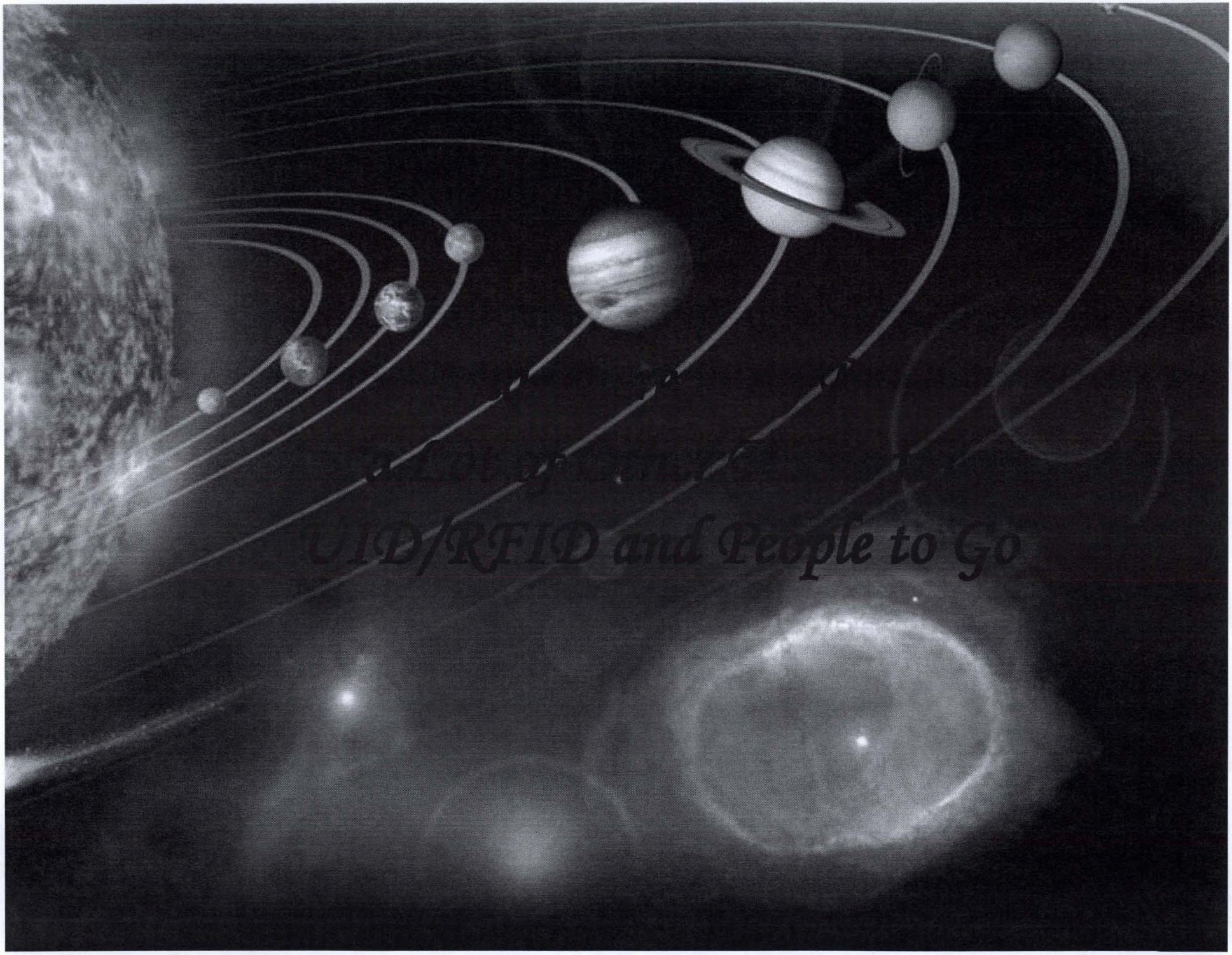

R
1

76503,7020
FOV:
~ 3 mm


Think of the people whose lives
will depend on the accuracy
of the logistics system






UID/RFID and People to Go